IN THE SPECIFICATION:

Please substitute the following paragraph for the paragraph starting at page 1, line 5 and ending at line 16.

The present invention relates to a manipulator such as a minute component assembly apparatus which ~~assemblies~~ assembles a minute object such as a micromachine component or unit by using a magnifying observation device such as an optical microscope, electron microscope, or scanning tunneling microscope, or a compact manipulator apparatus which performs diagnosis, medical treatment, research, biological production, or the like by physically manipulating, for example, minute tissues, cells, or genes of a living body and a minute object manipulating apparatus using the manipulator.

Please substitute the following paragraph for the paragraph starting at page 17, line 2 and ending at line 16.

Although Fig. 1 shows the rod-like vibration elements, vibration elements like those shown in Figs. 3A to 3D or Figs. 4A to 4D may be used. According to the form of the vibration actuator shown in Figs. 3A to 3D, a single vibration member 200 is formed by joining a cylindrical elastic member 201 to a disk-like elastic member 202. The elastic member 201 is actually divided into two portions, and piezoelectric elements 203 and 204 serving as two electro-mechanical energy converting elements are clamped between the two portions. Piezoelectric elements 205a to 205d serving as four electro-mechanical energy converting elements are arranged on the surface of the disk-like elastic member 202.

Please substitute the following paragraph for the paragraph starting at page 18, line 16 and ending at page 19, line 19.

According to the form of the vibration actuator shown in Figs. 4A to 4D, a single vibration member 300 is formed by joining a cylindrical elastic member 301 to a disk-like elastic member 302. The elastic member 301 incorporates a permanent magnet (not shown) to always attract a movable member 306 (the movable member 2 in Fig. 1) made of a magnetic material so as to obtain a pressing force. Four piezoelectric elements (polarized regions) 303a to 303d serving as electro-mechanical energy converting elements are arranged on the surface of the elastic member 302. By selectively supplying alternating signals to the piezoelectric elements 303a to 303d, the elastic member 301 serving as a driving portion can be displayed in the x-axis direction, y-axis direction, or z-axis direction, as shown in Figs. 4B to 4D. When the movable member 306 is to be rotated about the x-axis, a displacement in the y-axis direction (Fig. 4C) and a displacement in the z-axis direction (Fig. 4D), may be provided with, for example, a phase difference of 90°. When the movable member 306 is to be rotated about the y-axis, a displacement in the x-axis direction (Fig. 4B) and a displacement in the z-axis direction (Fig. 4D) may be provided with, for example, a phase difference of 90°. When the movable member 306 is to be rotated about the z-axis, a displacement in the x-axis direction (Fig. 4B) and a displacement in the y-axis direction (Fig. 4C) may be provided with, for example, a phase difference of 90°. Alternating signals are supplied to the piezoelectric elements 303a to 303d in the same manner as in the form shown in Figs. 3A to 3D.

Please substitute the following paragraph for the paragraph starting at page 19, line 20 and ending at page 20, line 11.

Alternatively, a plate-like vibration member like the one disclosed in Japanese Patent Laid-Open No. 2002-272147 may be used. Fig. 5 shows this vibration member. In this case, contact projections PC1 to PC4 are integrally formed at almost the ~~middles~~ middle portions of the four sides of a plate-like vibration member 402. A projection PG having a magnet 405 for attracting a movable member (the movable member 2 in Fig. 1) is formed at a central portion of the vibration member, and projections PE1 to PE4 are formed at the four corners of the vibration member. A vibration element 401 is formed by bonding/fixing a piezoelectric element 403 to the vibration member 302. The piezoelectric element 403 is driven to excite three different natural vibration modes in the vibration element 401. Combining these modes makes it possible to realize multiple degree-of-freedom driving, e.g., rotation about three orthogonal axes and rotation in two ~~direction~~ directions and about one axis.

Please substitute the following paragraph for the paragraph starting at page 21, line 8 and ending at page 22, line 2.

Reference numerals 8-1 and 8-2 denote optical sensors, which detect relative position changes of [[a]] vibration elements 20 and movable member 2. A technique like that disclosed in Japanese Patent Laid-Open No. 10-65882 can be used. The sensors 8-1 and 8-2 are identical sensors. The rotation axis and rotational speed of the movable member 2 can be obtained from movement information at two positions on the spherical surface. The sensors 8-1

and 8-2 are not limited to this system as long as they are two-dimensional position sensors. Although an example of a non-contact optical system is shown in Fig. 6, for example, a ball mouse system may be used, in which the ~~rotations~~ rotation of balls in contact with the movable member 2 are separately detected as rotation components around two axes in two directions. The sensors 8-1 and 8-2 are mounted on a base 10 with a fixed frame 9. The vibration elements 20 are mounted on the fixed frame 9 with arm portions 1-2' radially extending from an electrode plate portion for a piezoelectric ceramic 1-2. Other points are the same as those in the first embodiment.

Please substitute the following paragraph for the paragraph starting at page 24, line 7 and ending at line 23.

As has been described above, the manipulator according to a preferred embodiment of the present invention has a mechanism in which all rotatable shafts cross at one point, and the distal end portion of a manipulating member (end-effector) which manipulates a manipulation target object is placed near the intersection. With this structure, even if the posture of the manipulating member is changed, its distal end does not move. When, therefore, the operator is to manipulate a manipulation target object while observing it with a microscope or the like, the object can be made to always remain in the visual field. This eliminates the necessity of ~~position~~ positioning the microscope and end-effector again every time the position of the end-effector or manipulation target object (e.g., a minute object) is controlled. Therefore, very efficient operation can be performed.